

Use of health parameter trends to communicate pet health information in companion animal practice: A mixed methods analysis

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Abstract

Background: Reviewing patient health parameter trends can strengthen veterinarian–client–patient relationships. The objective of this study is to identify characteristics associated with veterinarians' communication of health parameter trends to companion animal clients.

Methods: Using a sequential exploratory mixed methods design, independent pet owner ($n = 27$) and veterinarian ($n = 24$) focus groups were conducted and analysed via content analysis to assess perceptions of how health parameter trends are communicated by veterinarians. Subsequently, a quantitative assessment of video recorded veterinary appointments ($n = 917$) compared characteristics identified in focus groups with health parameter trend discussions in practice. A mixed logistic model was used to assess characteristics associated with the occurrence of weight trend discussions.

Results: Fifteen characteristics relating to veterinarians' use of health parameter trends were identified across focus groups. Veterinarians discussed 77 health parameter trends in relation to bodyweight (57/77), blood work (15/77) and other health parameters (5/77), within 73 (73/917) appointments. The odds of a weight trend discussion were higher if the veterinarian identified the pet as overweight or obese compared to an ideal bodyweight (odds ratio (OR) = 2.17; 95% confidence interval (CI) = 1.15–4.09; $p = 0.016$).

Conclusion: Mention of a health parameter trend was uncommon and rarely included use of visual aids. Health parameter trends related to bodyweight were discussed reactively, rather than proactively.

INTRODUCTION

Over the past decade, initiatives have been established to develop resources for veterinary professionals to educate clients regarding the importance of preventive veterinary care.¹ In 2015, a survey conducted by the American Animal Hospital Association, found that 90% of pet owners reported that preventive care discussions were an important aspect of their pets' veterinary care.² Proactively monitoring health indicators, such as blood work parameters, benefits the patient medically and supports veterinary practices economically by maintaining a sustainable source of income.³ Tracking a patient's blood parameters over their lifetime may assist in diagnosing subclinical disease, as it has been found that one in seven adult pets and one in five senior pets require action to be taken following

collection and analysis of blood for a wellness profile.³ Recently, routine laboratory tests have been used to predict chronic kidney disease in cats using machine learning techniques.⁴ Veterinarians' ability to communicate the value of preventive care recommendations on a pet's future health and wellbeing is likely to be enhanced by following and communicating a patient's health parameter trends over time. Taking time to review a pet's health parameter trend could help veterinarians strengthen the bond with their clients and improve client adherence.²

In an online survey of veterinary clients, half reported not receiving a copy of their pet's blood test results.⁵ Consequently, pet owners rely heavily on communication with their veterinarian and veterinary practice to receive their pet's laboratory test results and to understand the implications of the results on

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their pet's health. Weight is another health parameter that can be readily monitored by a veterinary practice, can be tracked over the lifetime of a pet, and can provide significant health benefits by maintaining an animal at a lean body mass.⁶ In addition, monitoring pet weight over their life span may be beneficial in helping veterinarians to initiate conversations regarding weight management,⁷ which is particularly important due to associations between obesity and various chronic diseases.^{8,9} Understanding how health parameter trends are currently used by veterinarians to support information exchange with pet owners is a starting point for informing best practices on using health parameter trends to promote the prevention, maintenance, and diagnosis of disease.

While monitoring pet health parameter trends has begun to be promoted within the veterinary community,^{3,10} neither studies have explored what pet owners' or veterinarians' perceptions of using health parameter trends are, nor have any studies examined how pet health parameter trends are currently being used by veterinarians to communicate with clients during veterinary appointments. The objectives of the current study were to: (1) assess pet owners' and veterinarians' perceptions of how health parameter trends could be used to support information exchange in veterinary practice, (2) to compare these perceptions with how veterinarians are currently using health parameter trends to exchange information during veterinarian–client–patient interactions and (3) to examine characteristics that are associated with the occurrence of a discussion of a health parameter trend (i.e., weight).

MATERIALS AND METHODS

The study methodologies were approved by the University of Guelph Research Ethics Board (Focus Group REB: 19-05-003; Video Collection REB: 17-08-009). A sequential exploratory mixed methods design¹¹ was used. First, qualitative methods were used to assess pet owners' and veterinarians' perceptions of health parameter trends in companion animal practice. Second, quantitative methods were employed to examine veterinarians' current communication about health parameter trends during video recorded veterinarian–client–patient interactions in companion animal practice.

Qualitative study

Focus groups

Pet owners' and veterinarians' perceptions of veterinarians' use of health parameter trends to share information was explored as part of a larger study involving independent focus groups with 24 veterinarians and 27 pet owners, which has been previously described.¹² In short, independent focus groups of pet owners and veterinarians were conducted by the principal author (Natasha Janke) from July to October 2019 in Guelph and Kitchener, Ontario, Canada. A short demographic

survey was completed by each participant before each focus group session. All focus groups involved the use of a semi-structured discussion guide consisting of open-ended questions and follow-up probes. A series of questions were developed to assess veterinarians' and pet owners' perceptions of what clients consider positive and less than ideal experiences during veterinary visits, exploring in general and then more specifically in relation to information exchange.¹² Following these discussions in both the pet owner and veterinarian focus groups, the use of health parameter trends was explored by providing three examples of methods that could be used to present non-specific pet health information to a pet owner and eliciting participants' perceptions (see Supporting Information). All focus groups discussions were audio recorded and subsequently transcribed verbatim by an independent transcriptionist.

Manifest content analysis¹³ was used to explore portions of the transcripts specific to pet owners' and veterinarians' preferences for information shared by veterinarians when using health parameter trends with pet owners during veterinary appointments. Standard software* was used to support the content analysis. First, transcripts were reviewed by the principal author (Natasha Janke) for accuracy and familiarity. Second, open coding¹⁴ was conducted to develop codes related to veterinarians' use of health parameter trends to communicate pet health information. The codes captured from the focus group transcripts were subsequently used to develop a coding framework to examine veterinarians' use of trends during audio–video recorded veterinarian–client–patient interactions.

Quantitative study

Video data collection

Audio–video recorded companion animal veterinary appointments were collected as a part of a larger observational study, which has been previously described.¹⁵ In short, veterinarians were randomly selected from a list of 2234 companion animal veterinarians, retrieved from the College of Veterinarians of Ontario (www.cvo.org), who practiced within 150 km of the Ontario Veterinary College in Guelph, Ontario, Canada. Veterinarians were required to practice companion animal medicine at least 1 full day per week at a primary care practice. Veterinarians were contacted until 60 veterinarians provided consent to participate in the study. On the first study day, each participating veterinarian completed an initial questionnaire containing demographic questions.

For each participating veterinarian, a convenience sample of their clients were recruited in the lobby of the clinic. Participating clients completed a questionnaire containing demographic questions either before or after their appointment and their appointment was audio–video recorded[†]. All participants in

* Quirkos 2.3.1 (Computer Software), 2020. Retrieved from www.quirkos.com

† Hero5 edition, GoPro Inc., San Mateo, CA, USA.

the study were required to be at least 18 years of age and English speaking. Participants were excluded from the video recording if (1) all individuals in the appointment room had not provided consent, (2) the appointment was a planned euthanasia, or (3) if there was an accompanying minor present (i.e., an individual less than 18 years of age). After each interaction with a participating client, the veterinarian completed a brief questionnaire which included an assessment of the patient's body condition score (BCS), using a standard chart[‡].

Quantitative data analysis

Initially, all videos were coded for the presence of numerous topics related to animal health, including both health parameter trends and pet weight. For the purpose of the current study, a health parameter trend was defined as three or more values of a single health parameter measured at different times during a pet's life. Three values were selected as the minimum number of values to represent a trend because two values could differ simply due to random variation. All of the videos that were classified as having a discussion of a health parameter trend were reviewed by the principal author (Natasha Janke) and coded based on the coding framework developed from the focus groups to assess the prevalence and nature of communication related to health parameter trends. Proficiency codes for health parameter trends were used to indicate the presence or absence of criteria that emerged from the pet owner and veterinarian focus groups pertaining to trends, excluding the barriers raised by veterinarians. Each proficiency code was further categorised as being initiated by the veterinarian or client. Trend discussions were also classified as being retrospective (i.e., historical trend), prospective (i.e., future trend) or both. The type of trend examined was classified as bodyweight, blood work or other. Bodyweight trend discussions were classified as using numerical weight (kilograms or pounds), BCS, or both. BCS, originally measured on a nine-point scale, was recategorised as 'underweight' if BCS < 4 for dogs and BCS < 5 for cats, 'ideal weight' if BCS = 4 or 5 for dogs and BCS = 5 for cats, and 'overweight or obese' if BCS > 6 for both dogs and cats.¹⁶

Statistical analysis

Descriptive statistics were calculated for veterinarian and client demographics, in the qualitative and quantitative phases of the study. Frequencies were calculated for categorical variables and mean, median, and range for continuous variables. Including all video recorded interactions from the full dataset that contained any mention of the pet's bodyweight, associations among veterinarian, client, and appointment-level variables and the presence or absence of a weight

trend discussion were assessed using a mixed logistic regression model with veterinarian treated as a random effect. Only unique veterinarian–client dyads were included in the regression analysis, therefore, if clients participated in the study more than once, only their first visit was included. For multi-pet appointments, one pet was randomly selected for inclusion in the model. Initially, univariable analyses were conducted with all independent variables to assess unconditional associations ($p < 0.20$). Independent variables related to the veterinarian (e.g., years in practice, gender, practice location, etc.), client (e.g., age, gender, education, etc.), visit (e.g., visit type) and pet (e.g., BCS, age, species). Listwise deletion was used to handle missing data. Model building was performed using manual forward stepwise selection. Potential confounders were checked using a change in main effect coefficients of greater or equal to 30%.¹⁷ A significance level of $p < 0.05$ was used for the final model. Statistical analyses were performed using standard statistical software[†].

RESULTS

Pet owner and veterinarian focus groups

Twenty-seven pet owners participated in five focus groups, ranging from two to nine participants each. Participants owned a mean of two pets (range = 1–12) and visited a veterinarian at least once per year. The majority of participating pet owners identified as female (24/27), while three identified as male. Participating pet owners had been visiting a veterinarian for a median of 17.5 years (mean = 19.1; range = 1.5–47).

Twenty-four companion animal veterinarians participated in three focus groups, ranging from six to 10 participants each, half of whom practiced full time, while the remaining practiced part time. The majority of veterinarians identified as female (female = 22; male = 2), with a median of 14.5 years since graduation (mean = 17.2; range = 2–41). Twelve of the participating veterinarians were practice owners or partners, 11 were associate veterinarians, and one was a locum. All except two veterinarians were recruited from separate clinics.

Fifteen codes were identified through content analysis of the focus groups (Table 1). During video analysis, it became evident that veterinarians did not distinctly communicate recommended 'next steps' separately from 'preventive measures' and were combined to create a single proficiency code signifying that 'next steps' were discussed in relation to the health parameter trend examined, whether or not they were preventive. Consequently, 14 proficiency codes were identified for use in the quantitative analysis of this study. In addition, veterinarian participants described four reasons why they might not communicate a health parameter trend to their client, which could not be observed during an appointment (Table 2).

[‡] WSAVA Global Nutrition Committee Body Condition Score Chart, 2013.

[†] SAS, University Edition, SAS Institute Inc., Cary, NC, USA.

TABLE 1 Representation of codes identified via content analysis that emerged from focus groups (FGs) of pet owners (five FGs; 27 participants) and veterinarians (three FGs; 24 veterinarians) exploring veterinarians' use of health parameter trends during veterinarian–client–patient interactions in Ontario, Canada

Codes	Pet owners' descriptions	Veterinarians' description
Direction of trend	In five FGs, pet owners wanted to know if the trend is increasing, decreasing, or remaining stable, even if the current value is in the normal range.	In three FGs, veterinarians described the importance of telling clients whether their pets' values were trending up, down, or remaining stable.
Baseline	In three FGs, pet owners emphasised the importance of having baseline blood parameters for their pet when discussing historical trends or when making the decision to start trending parameters going forward.	In two FGs, veterinarians mentioned letting clients know the importance of having baseline blood parameters when making recommendations for wellness blood work, which they could then use to compare results going forward.
Ideal weight	In three FGs, pet owners described the importance of knowing what is considered an ideal weight for their pet.	In two FGs, veterinarians expressed that pet owners often wanted to know the exact ideal bodyweight of their pet as it provided a goal to work towards. Most veterinarians preferred to discuss ideal body condition.
Numerical values	In three FGs, pet owners wanted to be told the numerical values of their pet's results, rather than only being told they are ' <i>in the normal range</i> '. Pet owners felt it was important to hear where their pet's value falls within the normal range.	In three FGs, veterinarians had differing opinions on whether or not they share numerical values with their clients. A portion of veterinarian participants had the mindset that ' <i>[pet owners] don't even care about the values</i> ' when describing values trended over time.
Visual aids	In five FGs, it was unanimous that visual aids must be used to supplement a discussion with their veterinarian, not in replacement of a discussion. Many pet owners also emphasised that visual aids should include precise values and dates on which the values were obtained.	In three FGs, veterinarians thought that clients are more receptive to visual aids, rather than being told the numbers verbally, especially useful to show changes in a pet's weight. Some veterinarians also specified that graphs should include numerical values on each data point.
Visual aid printout	In five FGs, pet owners expressed the usefulness of having a printout of their pet's trends to make notes during their discussion with their veterinarian and reflect and recall the discussion after the appointment, as well as to keep their pet's values in their own files.	In two FGs, veterinarians described sending their clients home with a printout of the health parameter trend yet indicating only if the client asked for a copy.
Graph versus table	In five FGs, pet owners had differences in opinions on whether they would prefer values to be presented in a graph or a table form. Several pet owners stated that it would depend on which health parameter is being trended and also on individual preference. Pet owners also described wanting visual aids to be colour coded, with colours representing low normal, high normal, and abnormal.	In three FGs, most veterinarians felt that a graph would be easier to comprehend for clients, require less explanation, help them communicate the value of the information, and potentially contribute to a more effective conversation as it ' <i>adds credibility to what you're saying</i> '. It was also mentioned that any visual aids should have colour so that clients can associate certain colours with values being within the normal range or outside of the normal range.
Comparison to last visit (veterinarians only)	n/a	In three FGs, veterinarians mentioned providing the difference in values from the last visit compared to the current value when discussing trends. Some veterinarians mentioned that their clients often initiated these discussions so that they can know how much of a change there has been since their last visit to the veterinarian.
Normal range (veterinarians only)	n/a	In three FGs, veterinarians mentioned letting the client know if their pet's current health parameter value was within the normal range when describing a trend. Some veterinarians mentioned that having the normal range on a graph is helpful for clients to visualise where their pet's current value is in relation to the normal range.

(Continues)

TABLE 1 (Continued)

Codes	Pet owners' descriptions	Veterinarians' description
Clinical significance	In five FGs, pet owners wanted to know ' <i>what this means</i> ' for their pet and what the impact would be on their pet if the trend continued. Some pet owners emphasised that they wanted their veterinarian to tell them matter of fact what would occur if they did not make any changes.	In three FGs, veterinarians mentioned the importance of letting the client know ' <i>what does it mean?</i> ' for the pet when discussing health parameter trends.
Reflecting on previous changes	In five FGs, pet owners wanted to know ' <i>why is it happening?</i> '. Pet owners wanted the opportunity to reflect on lifestyle changes that occurred when health parameters began changing, such as, reflecting on changes in diet or exercise when looking at a historical weight trend.	In three FGs, veterinarians described using retrospective data trends to reflect on lifestyle changes that may have impacted the health parameters they are examining.
Clinical signs (pet owners only)	In three FGs, pet owners mentioned wanting to have a discussion of clinical signs related to the health parameter trend they were discussing. If no clinical signs were evident, pet owners wanted to be told what to look out for at home.	n/a
Life stage expectations (pet owners only)	In three FGs, pet owners recognised that expectations of certain health parameters will change throughout their pet's life, therefore, they wanted their veterinarian to explain where their pet's value is in relation to what the veterinarian would expect ' <i>based on the breed and age</i> '.	n/a
Preventive measures	In three FGs, pet owners wanted to be provided with measures that could be taken to prevent future health problems based on the health parameters they were trending.	In three FGs, veterinarians described the importance of educating clients on the significance of early identification of disease as this would allow for early interventions to slow or stop the progression of disease.
Next steps	In five FGs, pet owners wanted to know what steps need to be taken next. Pet owners wanted to know if there were actions that could be taken to help improve their pet's health. Several pet owners described wanting to know whether actions were related to preventing, maintaining, or treating a diagnosis.	In three FGs, veterinarians described using trends to highlight the need for clients to make lifestyle changes with their pets and create a plan for next steps.

Audio–video recorded veterinarian–client–patient interactions

Of the 917 audio–video recorded appointments, 73 appointments included a discussion between the veterinarian and client(s) involving a health parameter trend. Four appointments included discussion of two different health parameter trends, resulting in a total of 77 discussions. Differences in denominators described hereafter are due to missing values. The majority of participating pet owners identified as women (74%; 601/815), followed by men (26%; 212/815) and non-binary (<1%; 2/815). Participating pet owners had known the veterinarian for a median of 3 years (mean = 6.5; range = 0–50; $n = 802$). Participating clients had a mean age of 46 (median = 47; range = 19–84; $n = 795$). Most participants had a college diploma ($n = 234$), while 177 had a bachelor's degree, 139 had a graduate degree or professional degree, 134 completed some college, 106 were high school graduates and 16 had less than a high school education. One hundred and fifty-seven par-

ticipants had an annual household income of less than \$50,000, 236 made between \$50,000 and \$99,999, 150 made between \$100,000 and \$149,999, and 168 made \$150,000 or more. The majority of these appointments were wellness appointments (45%; 393/867), followed by initial health problem appointments (31%; 270/867), recheck or follow-up appointments (20%; 172/867), and other (4%; 32/867), as identified by the participating veterinarian.

A total of 38 out of 60 veterinarians had at least one discussion of a health parameter trend, with a range of one to eight appointments per veterinarian. Of the 60 veterinarians, 36 were practice owners, while 24 were associates or locums. The median number of years in practice were 22.0 (mean = 20.4), ranging from 2 to 39. The majority of veterinarians identified as female (65%; 39/60), while the remainder identified as male (35%; 21/60). Forty-two (70%; 42/60) veterinarians practiced in urban communities, while 18 (30%; 18/60) practiced in rural communities. Most veterinarians (62%; 37/60) reported having some form of previous communication training.

TABLE 2 Representation of codes identified via content analysis as barriers to using health parameter trends with clients from three veterinarian focus groups (FG) (no. of veterinarians = 24) exploring veterinarians' use of health parameter trends during veterinarian–client–patient interactions in Ontario, Canada

Barriers to using health parameter trends	No. of FG
Client reaction	3
Method of communication	2
Cost	2
Time	2

In three FGs, veterinarians emphasised that their use of trends was dependent on the client; described not wanting to use trends with clients who overreact to minimal changes in their pet's health, therefore some had a preference to generalise the findings to reduce their client's concerns. Some mentioned that some clients do not want the amount of information provided when describing a pet's trend.

In two FGs, veterinarians preferred to have conversations about trends in person rather than on the phone. Veterinarians described difficulties describing trends over the phone and wished it was easier to email visual aids to a client, for example, a graph of their pet's health parameters. However, most veterinarians mentioned that the software used to make the graphs does not allow them to send it in an email.

In two FGs, cost associated with parameters that require clients to spend money, such as blood tests, were considered a barrier to trending certain health parameters as clients may not see the value in spending the money. Some veterinarians believed that clients who did not see the value in past services, become less willing to spend money to trend values in the future.

In two FGs, time associated with preparing visual aids of health parameters over time was considered a barrier to their use. Conversely, some veterinarians felt visual aids may help with appointment efficiency as they can spend more time focusing on next steps.

Veterinarians' use of health parameter trends during audio–video recorded veterinarian–client–patient interactions

Of the 77 discussions of a health parameter trend identified, 65 (84.4%; 65/77) were initiated by the veterinarian and 12 (15.6%; 12/77) were initiated by the client. The majority (74%; 57/77) of health parameter trends discussed were focused on bodyweight, followed by blood work (19.5%; 15/77) and other (6.5%; 5/77). Of the 15 discussions of blood work trends, five were focused on complete blood chemistry profiles, four were specific to kidney values, four were specific to thyroid values, one was specific to blood glucose concentration, and one was specific to liver values. Five 'other' trends were discussed: urine cortisol concentration, heart rate, size of mass, respiratory rate, and body temperature.

During the 57 discussions of weight trends, the veterinarian described numerical bodyweight in 47 (82.5%; 47/57) using pounds or kilograms, while in 10 (17.5%; 10/57) the veterinarian described bodyweight using both numerical weight and BCS. Most discussions of a bodyweight trend were retrospective (74%; 42/57), while 15 (26%; 15/57) were both retrospective and prospective (e.g., describing historical bodyweight trend and planning for future weigh-ins). The minimum amount of time spent discussing a weight trend was 10 seconds, while the maximum was 7 minutes 17 seconds (median: 1 minute 36 seconds; mean: 2 minutes 12 seconds; SD = 1 minute 49 seconds). Results pertaining to the nature of bodyweight trend discussions are displayed in Table 3.

The 15 blood work and five other trend discussions included four (20%; 4/20) retrospective discussions, seven (35%; 7/20) prospective discussions, and nine discussions (45%; 9/20) that were both retrospective and prospective. The minimum amount of time spent discussing blood work or other health parameter trends was 44 seconds, and the maximum was 9 minutes 10 seconds (median: 2 minutes 22 seconds; mean: 3 minutes 5 seconds; SD = 2 minutes 17 seconds). Results pertaining to the nature of blood work and other trend discussions are displayed in Table 4.

Factors associated with the presence of a weight trend discussion

A total of 529 out of the 917 audio–video recorded appointments (58%) included a mention of the pet's bodyweight by the veterinarian. Five appointments were excluded in the analysis as the clients had already participated, leaving a total of 524 appointments included in the analysis. Of these, 249 pets were categorised as having an ideal BCS, 242 were categorised as overweight or obese, 30 were categorised as underweight, and three had missing values. The final mixed logistic regression model included pet's BCS ($p = 0.034$), while accounting for random effects at the veterinarian level. The odds of a trend discussion occurring during an appointment were significantly higher if the pet's BCS was categorised as overweight or

TABLE 3 Proficiency codes mentioned during bodyweight trend discussions ($n = 57$) between veterinarians and their clients, who initiated each topic, and example statements that would indicate the topic was mentioned

	Mentioned? Yes/No, <i>n</i> (%)	If yes, who initiated?, <i>n</i> (%)	Examples of veterinarians' statements
Direction of trend	Yes (direction)—38 (66.7) Yes (stable)—18 (31.6) No—1 (1.7)	Veterinarian—42 (75.0) Client—14 (25.0)	'Maggie's weight has been trending up' 'It looks like his weight has been stable'
Numerical values	Yes—46 (80.7) No—11 (19.3)	Veterinarian—33 (71.1) Client—13 (28.9)	'Today his weight is 6 kg'
Visual aids	Yes—6 (10.5) No—51 (89.5)	Veterinarian—6 (100) Client—0 (0)	'You can see here on the graph, her weight has been steadily increasing'
Copy of visual aid provided to client?	Yes—1 (1.7) No—56 (98.3)	Veterinarian—1 (100) Client—0 (0)	'I'll give you a copy of this graph to take home and show rest of household'
If used, type of visual aid used	Graph—5 (83.3) Unknown—1 (16.7)	Veterinarian—6 (100) Client—0 (0)	'Take a look at this graph'
Current bodyweight	Yes—48 (84.2) No—9 (15.8)	Veterinarian—34 (70.8) Client—14 (29.2)	'Today his weight is 6 kg'
Comparison to last visit	Yes—42 (73.7) No—15 (26.3)	Veterinarian—33 (78.6) Client—9 (21.4)	'Today his weight is 6 kg and the last visit he was 6.4 kg'
Ideal weight/BCS	Yes—21 (36.8) No—36 (63.2)	Veterinarian—17 (80.9) Client 4 (19.1)	'We want her to be around 8 lbs' 'We want to see her BCS at a 5 out of 9'
Comparison of current weight to ideal weight/BCS	Yes—19 (33.3) No—38 (66.7)	Veterinarian—17 (89.5) Client—2 (10.5)	'We want her to be around 8 lbs and right now she's 11 lbs'
Clinical significance			
Explanation of medical information obtained	Yes—15 (26.3) No—42 (73.7)	Veterinarian—14 (93.3) Client—1 (6.7)	'We can see from his previous few weigh-ins, he's been putting on weight'
Explanation of effect on health/wellbeing of pet	Yes—9 (15.8) No—48 (84.2)	Veterinarian—8 (88.9) Client—1 (11.1)	'The extra weight is affecting his mobility and could lead to arthritis'
Clinical signs	Yes—11 (19.3) No—46 (80.7)	Veterinarian—9 (81.8) Client—2 (18.2)	'Has he been limping or having trouble going up and down the stairs?'
Reflecting on previous changes	Yes—40 (71.2) No—17 (29.8)	Veterinarian—13 (32.5) Client—27 (67.5)	'Has he been getting more walks now that the weather is nice?'
Life stage expectations	Yes—8 (14.0) No—49 (86.0)	Veterinarian—7 (87.5) Client—1 (12.5)	'His metabolism is slowing down as he ages so you're going to want to reduce the amount of food you're feeding him'
Next steps	Yes—40 (71.2) No—17 (29.8)	Veterinarian—36 (90.0) Client—4 (10.0)	'Bring him in at the end of each month for a weigh-in'
Explanation of medical information to be obtained	Yes—22 (55.0) No—18 (45.0)		'You're going to want to keep exercising her to get her weight down to ideal'
Explanation of effect on health/wellbeing of pet	Yes—10 (25.0) No—30 (75.0)		'Reducing weight will help keep away the skin infection between her skin folds which should alleviate some discomfort'

Note: Results from analysis of audio–video recorded veterinarian–client–patient interactions collected from companion animal practices in Ontario, Canada. Abbreviation: BCS, body condition score.

obese compared to ideal (odds ratio [OR] = 2.17; 95% confidence interval [CI] = 1.15–4.09; $p = 0.016$). There was no significant difference in the odds of a trend discussion occurring between appointments where the pet's BCS was categorised as underweight compared to ideal (OR = 2.75; 95% CI = 0.89–8.55; $p = 0.08$) or overweight or obese compared to underweight (OR = 0.79; 95% CI = 0.26–2.36; $p = 0.67$).

DISCUSSION

In the present study, pet owners participating in the focus groups indicated an interest in being provided with information relating to their pet's health param-

eter trends, yet the analysis of recorded veterinarian–client interactions suggests that fewer than 10% of veterinary appointments included a discussion of any health parameter trend. Veterinarians participating in the focus group portion of the study identified multiple barriers that may deter veterinarians from using health parameter trends with their clients. Consistent with previous research,¹⁸ the present study found that lack of time was a self-reported barrier veterinarians identified, which may impact their communication with a client. While a lack of time may contribute to the relatively low prevalence of health parameters used during veterinarian–client interactions, it is possible using a visual aid to communicate a patient's health parameter trend may improve a client's

TABLE 4 Proficiency codes mentioned during blood work and other health parameter trend discussions ($n = 20$), excluding bodyweight, between veterinarians and their clients, who initiated each topic, and example statements that would indicate the topic was mentioned

	Mentioned? Yes/No, n (%)	If yes, who initiated?, n (%)	Examples of veterinarians' statements
Direction of trend	Yes (direction)—5 (25.0) Yes (stable)—3 (15.0) No—12 (60.0)	Veterinarian—7 (87.5) Client—1 (12.5)	'We can see his thyroid levels are climbing'
Baseline	Yes—3 (15.8) No—16 (84.2) N/A—1	Veterinarian—3 (100.0) Client—0 (0)	'We should get a baseline of her blood pressure'
Numerical values	Yes—9 (45.0) No—11 (55.0)	Veterinarian—7 (77.8) Client—2 (22.2)	'His thyroid is 52'
Visual aids	Yes—2 (10.0) No—18 (90.0)	Veterinarian—2 (100.0) Client—0 (0)	'I want to review a trending chart of all of his previous blood work on my computer'
Copy of visual aid provided to client?	Yes—0 (0) No—20 (100.0)	Veterinarian—N/A Client—N/A	
Type of visual aid used	Graph—2 (100.0)	Veterinarian—2 (100.0) Client—0 (0)	'This is what a normal glucose curve looks like and this is what his looks like'
Current value	Yes—7 (35.0) No—13 (65.0)	Veterinarian—6 (85.7) Client—1 (14.3)	'Her SDMA is down to 19'
Comparison to last visit	Yes—5 (25.0) No—15 (75.0)	Veterinarian—5 (100.0) Client—0 (0)	'Last time it was 19 too so she's actually been quite stable'
Normal range provided	Yes—3 (15.0) No—16 (80.0) N/A—1 (5.0)	Veterinarian—3 (100) Client—0 (0)	'Normal is 0.2 or 0.1'
Description of 'normal' results	Yes (high/low/mid)—6 (60.0) Yes ('normal')—2 (20.0) No—2 (20.0) N/A—10	Veterinarian—5 (83.3) Client—1 (16.7)	'Her values are still within the normal range but they are high'
Clinical significance			
Explanation of medical information obtained	Yes—16 (80.0) No—4 (20.0)	Veterinarian—15 (93.8) Client—1 (6.2)	'We're watching her RBC count'
Explanation of effect on health/wellbeing of pet	Yes—12 (60.0) No—8 (40.0)	Veterinarian—12 (100) Client—0 (0)	'We're watching her RBC count because sometimes they become anemic and it will help us monitor her health'
Clinical signs	Yes—12 (60.0) No—8 (40.0)	Veterinarian—5 (41.7) Client—7 (58.3)	'Have you noticed him drinking more? Peeing more?'
Reflecting on previous changes	Yes—6 (30.0) No—14 (70.0)	Veterinarian—4 (66.7) Client—2 (33.3)	'This was when we put him on medication, and that was when we switched his diet'
Life stage expectations	Yes—7 (35.0) No—13 (65.0)	Veterinarian—5 (71.4) Client—2 (28.6)	'This becomes more common in older dogs like him'
Next steps	Yes—17 (85.0) No—3 (15.0)	Veterinarian—17 (100.0) Client—0 (0)	'I would suggest rechecking the thyroid'
Explanation of medical information to be obtained	Yes—14 (82.4) No—3 (17.7)		'We will be able to see if the thyroid is dropping to the lower end'
Explanation of effect on health/wellbeing of pet	Yes—10 (58.8) No—7 (41.2)		'If we find he is hypothyroid, then we can put him on a thyroid supplement which should help with [clinical signs]'

Note: Results from analysis of audio–video recorded veterinarian–client–patient interactions collected from companion animal practices in Ontario, Canada. Abbreviation: RBC, red blood cell. SDMA, symmetric dimethylarginine

understanding and adherence to a veterinarian's recommendation, especially for preventive care, warranting further research.

Veterinarians in the present study rarely identified when their recommendations for next steps were specifically preventive, suggesting an opportu-

nity exists for veterinarians to increase the clarity of their preventive care recommendations. Preventive care provides several advantages in veterinary medicine, including, maintaining the health of animals, earlier detection of disease, and decreased cost of veterinary care long term. Additionally, most pet

owners believe having a discussion regarding preventive care is important to their pet's health.² Identifying recommendations as preventive could help increase frequency of client visits¹⁹ and improve adherence to recommendations.²⁰ Thus, it is critical for veterinarians to clearly communicate when preventive measures are being recommended and how they may help maintain a pet's health and wellbeing.

The majority of health parameter trends discussed in the current study were related to the pet's bodyweight. The odds of a weight trend discussion occurring were significantly higher if the pet was considered overweight compared to an ideal weight. Further, three quarters of discussions that included a weight trend addressed the weight trend retrospectively, yet no weight trend discussions were exclusively prospective. Together, these findings further suggest that veterinarians in the current study used weight trends reactively (i.e., to illustrate a problem), rather than proactively (i.e., to prevent a problem). In 2018, 59.5% of cats and 55.8% of dogs were found to be overweight or obese, according to the Association for Pet Obesity Prevention.²¹ With rising concerns regarding the prevalence of animal obesity, delaying conversations regarding a pet's weight until the animal is classified as overweight or obese is detrimental to the animal's health.

Veterinarians in the current study infrequently explained the impact of the pet's weight status on the pet's overall health and wellbeing when discussing a weight trend with a client. Evidence-based research has identified associations between obesity and chronic disease in pets.^{8,9} Maintaining a lean bodyweight has been associated with delayed onset of chronic diseases, such as osteoarthritis, and a longer life span.⁶ Considering the impact of weight on pets' overall health, there is an opportunity for veterinarians to educate clients about how monitoring bodyweight can be used to enhance a pet's overall care. First time visits provide an opportunity for veterinarians to engage clients in discussions relating to the importance of monitoring the bodyweight trend of a pet into the future. Acknowledging how health parameter trends can help prevent or minimise future health problems through early detection could be used to help clients perceive the value of regular veterinary visits.^{19,22,23}

Pet owner focus group participants acknowledged the importance of discussing life stages in relation to health parameter trends. Yet, this topic was not identified in veterinarian focus groups and was infrequently mentioned during health parameter trend conversations. Pet owners expressed an appreciation for information related to the development of their pets, such as, what their pet's bodyweight trend should look like based on their age and breed. A previous study²⁴ assessed the occurrence of anticipatory guidance, defined as the presentation of information on the normal development across different life stages of a pet, and found that veterinarians rarely obtained or provided information related to anticipatory guidance during companion animal appoint-

ments. Evidence-based growth charts for dogs, based on weight class, have been developed for use in companion animal practice.²⁵ Use of growth charts during the early stages of an animal's life would enable veterinarians and pet owners to monitor the trend in a pet's growth in order to identify early growth patterns that may suggest potential future problems.²⁶ Trending pet bodyweight early in a pet's life may increase client comprehension of healthy bodyweight and promote engagement of preventive measures which maintain the pet at a healthy weight long term.

The second most prominent discussion of trends identified in the current study was related to blood work. Veterinarians who participated in the focus groups identified cost, including perceived value by the client, as a potential barrier to regular wellness screening for pets. Tracking patients' health parameters over time can help veterinarians identify early indications of subclinical disease, enabling earlier intervention, and improved health outcomes.²⁷ However, veterinarians most often describe cost in relation to the veterinarian's time or service being provided, rather than emphasising the impact on the future health and wellbeing of the patient.²³ There is potential for veterinarians to increase client adherence to blood work by educating clients about the ability to track their pet's health over time.² Ultimately, improving the patient's health by being able to take a proactive approach to veterinary care.

Veterinarians participating in the focus groups conveyed clients may be more receptive to visual aids, such as graphs, compared to verbal conversations alone. Yet in the observational portion of the present study, only seven of 77 (9%) discussions included the use of a visual aid to support the veterinarian's discussion of a health parameter trend. Pet owners expect to be provided information in multiple formats.^{18,28} Participants in the current study emphasised that visual aids should be used to supplement, not replace, a verbal explanation of a pet's health parameter trend. Providing participants with examples of visual aids during the focus groups, could have prompted participants to express higher expectations on the use of visual aids. Nonetheless, this enabled the identification of the low prevalence of visual aids used during veterinarian–client–patient interactions and the opportunity to use visual aids to assist discussions of health parameter trends.

In human medicine, physicians' use of visual aids enhanced patient adherence as well as recall and understanding of information.²⁹ While veterinarians expressed an overall positive reaction to the impact that visual aids could have on client comprehension, the time associated with generating visual aids for clients was identified by veterinarians as a barrier to their use. Consequently, a favourable next step for the veterinary field would be the implementation or further development of software that can efficiently create personalised visual aids from electronic medical records during a veterinary appointment, including species and breed appropriate reference information to support

veterinary professionals' communication of health parameter trends.

The mixed methods approach used herein enriched the present study findings, yet some study limitations should be considered. Firstly, the focus groups were conducted with a convenience sample of pet owners and a randomised sample of veterinarians within a specific geographic location. Therefore, it is possible that pet owners and veterinarians in different geographic locations or with different influences, may have different or additional perspectives in relation to the discussion of health parameter trends than identified in the current study. Secondly, in a separate study that assessed mental health scores for the same sample of veterinarians used in the recorded appointments, Perret et al.³⁰ found that veterinarians in the present study had higher mental health scores, signifying improved mental wellness, compared to another study sample representing 10% of veterinarians across Canada,³¹ suggesting potential selection bias. Additionally, the veterinarians in this study may have been more confident in their communication skills, displayed by demonstrating more interest in aiding a study related to communication, or had more time, which led them to participate in a study examining veterinarian–client communication compared to veterinarians who declined to participate.

This study has identified the low prevalence of health parameter trend discussions in companion animal practice. Findings indicate that opportunities exist for veterinarians to specify when their recommendations are preventive, and to be more proactive when discussing bodyweight trends with pet owners. Preventive care consultations could benefit from veterinarians' use of health parameter trends, including both verbal discussions and visual aids. As an example, it would be beneficial to specifically promote the use of bodyweight trends over time to monitor pet weight whether the focus is on prevention, maintenance, or weight loss. Many veterinary organisations recommend the use of medical records for tracking bodyweight and BCS, including the use of growth charts as a tool for monitoring healthy growth.^{25,32–34} In addition, annual blood work has been recommended based on the life stage of a pet and can be used to proactively monitor clinically significant changes in blood parameters.^{3,27,32,33} Further emphasis by these organisations, promoting the discussion of trends over time with pet owners, may help clients understand the value of proactive monitoring and help further develop collaborative relationships between pet owners and veterinarians to provide optimal preventive health care for pets.

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CONFLICTS OF INTEREST

Jason B. Coe regularly receives research grants, consults for, and receives honoraria from a variety of veterinary organizations, including Royal Canin. The position of Theresa M. Bernardo is funded through a gift from IDEXX Laboratories to the University of Guelph. Although there was no direct contact or influence regarding this work, the outcomes may be useful to Royal Canin or IDEXX Laboratories. The remaining authors declare no conflicts of interest.


AUTHOR CONTRIBUTIONS

Natasha Janke, Jason B. Coe, Theresa M. Bernardo, Cate E. Dewey and Elizabeth A. Stone conceived the study and developed the methodology. Jason B. Coe supervised and Jason B. Coe, Elizabeth A. Stone and Natasha Janke secured funding and resources. Natasha Janke and Jason B. Coe were responsible for data curation and project administration. Natasha Janke conducted the qualitative and quantitative data analysis and all authors contributed to the interpretation. Natasha Janke wrote the first draft of the manuscript, and all authors contributed to manuscript revisions and approved the submitted version. Natasha Janke is the guarantor of this manuscript.

DATA AVAILABILITY STATEMENT

The data are not readily available due to privacy or ethical restrictions.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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